Space Weather Technical Forecast

Issued on Tuesday, 22 November 2022 at 12:48 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Daily Slight Chance of R1/R2 radio blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low in the past 24 hours, with the largest X-ray flare of the period an isolated C7.0 flare at 22/0727 UTC. This flare emanated from AR3151, Beta/Cai, which has developed in the past 24 hours and continues to grow. The two other regions on the visible disk, AR3147 Beta/Cho and AR3149 Beta/Dai are both stable. AR3150 rotated off the west limb and AR3148 faded to plage.
No new Earth directed Coronal Mass Ejections (CMEs) were seen in available imagery. Though we are waiting for imagery from Lasco to establish whether a CME was associated with the C7.0 flare from 22/0727 UTC.

Solar Wind / Geomagnetic Activity: The solar wind was slowly easing through the period to background levels around 380 km/s with the phi angle accordingly mostly negative (towards the Sun) throughout. Density has been mostly average. The IMF was weak below 8 nT. The north-south component was erratic but generally weak between +5/-4 nT.
The net effect of the above solar wind measures was for Quiet geomagnetic activity, (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) as measured at GOES16 has remained at Background levels.
High energy electron flux (greater than 2MeV) at GOES16 was at Normal Background levels throughout. Electron fluence levels remained well below Active (1e8 integrated pfu) levels. Observed fluence at 22/0001 UTC was 1.5e6 integrated pfu.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to remain Low, with a daily Slight Chance of isolated M-class X-ray flares.

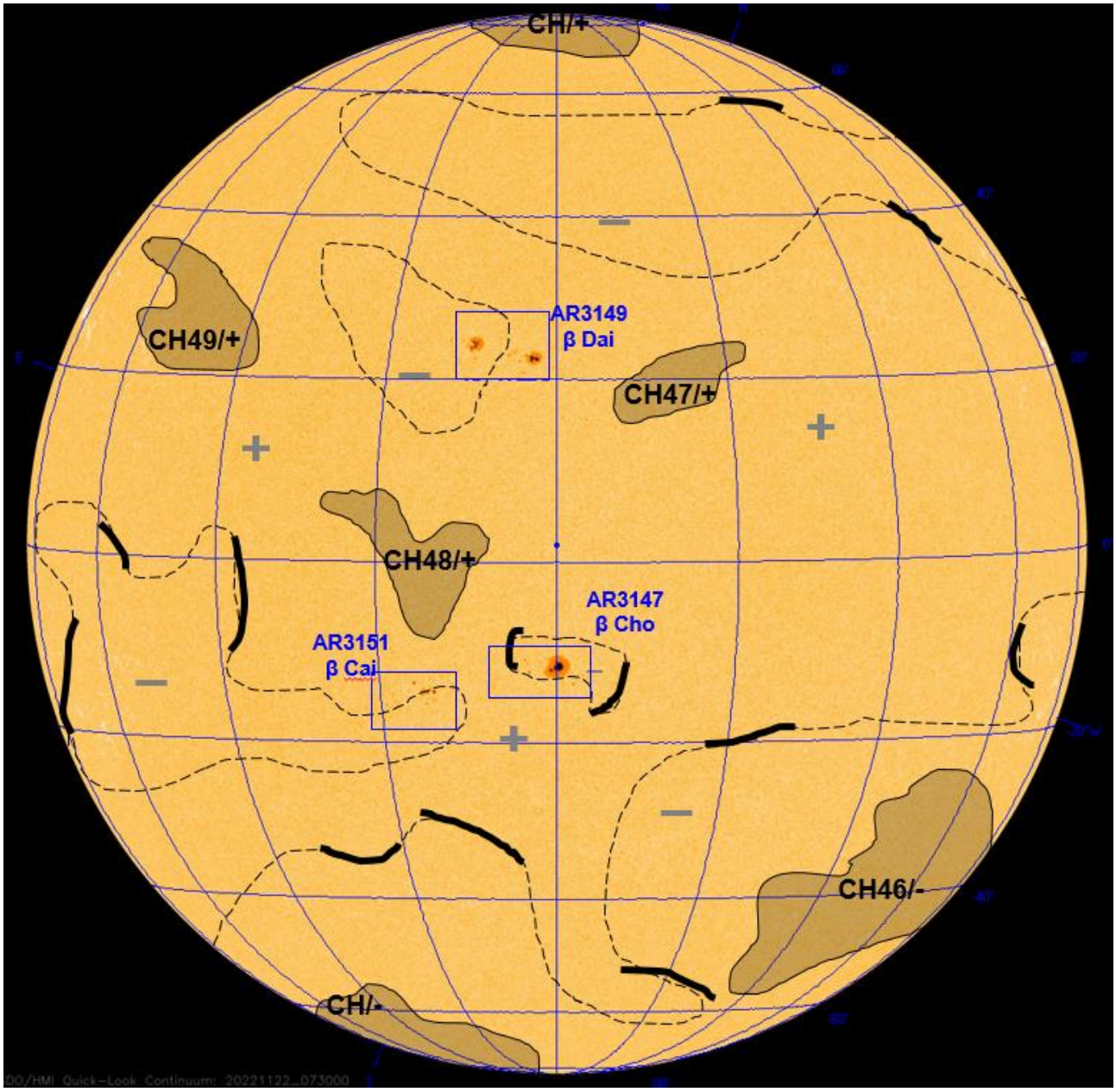
Solar Wind / Geomagnetic Activity: There is one CME in the forecast that may glance Earth either late day 1 or early day 2, Tuesday 22 and Wednesday 23 November. This is the large filament lift-off from 19 November that crossed the solar meridian to give a northwestward-heading northeastern quadrant filament.
The current solar wind should continue to ease through day 1. A slow regime should follow for a time, perhaps interrupted by the above CME before a second coronal hole high speed stream potentially arrives on day 3, Thursday 24th November. A third fast wind, due to follow this on day four by 27-day persistence, is not expected until the UTC weekend.
The upshot of the above forecast is a daily Slight Chance of Minor Geomagnetic Storm G1 on days 1 to 3 (22nd to 24th), probably falling to Quiet or Unsettled on day 4 (Friday 25th November), with this late quieter interlude of low confidence.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) observed by GOES16 is expected to remain at Background levels throughout.
Electron flux is forecast to remain near currently observed levels at GOES16. The next fast wind is not likely to significantly alter this regime, and CH48 is both later and more tenuous than on last pass, meaning that 24-hour integrated fluence is expected to remain below Active throughout, albeit with slightly reducing confidence towards day 4 (25th).

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Figure 1. Solar Analysis Valid 22/0730UTC.



.

Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Geomagnetic Storms:

There is currently one CME that features in the four-day forecast. This feature emanated from the northeastern solar hemisphere on Saturday 19 November. This CME is expected to graze Earth later on the UTC day of day 1 or early day 2 (22nd/23rd) with a Slight Chance of G1 now spanning both 24-hour periods.

A slow solar wind regime should ensue for a time, before coronal hole CH47/+ impacts potentially arrive on day 3 (Thursday 24 November). This should again offer a Slight Chance of G1, but ought to be short-lived for its small span on the disc and tenuous character. Confidence then lowers through day four, with CH48/+ due based on 27-day persistence, but changes in its geometry between last pass and recent imagery suggest it may now fall outside the forecast period, perhaps arriving into the coming UTC weekend instead.

The resulting forecast is a Slight Chance of G1 on days one to three (22nd-24th), probably falling on Friday ahead of a further similar magnitude enhancement to come into the UTC weekend. The forecast quieter window on Friday 25 November is considered low confidence.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
19/1650	Partial	Filament eruption	NE quadrant	490km/s	22/2359UTC +/- 8 hours.	Low confidence, lack of CH46 fast wind will Slow transit. Glancing Blow.

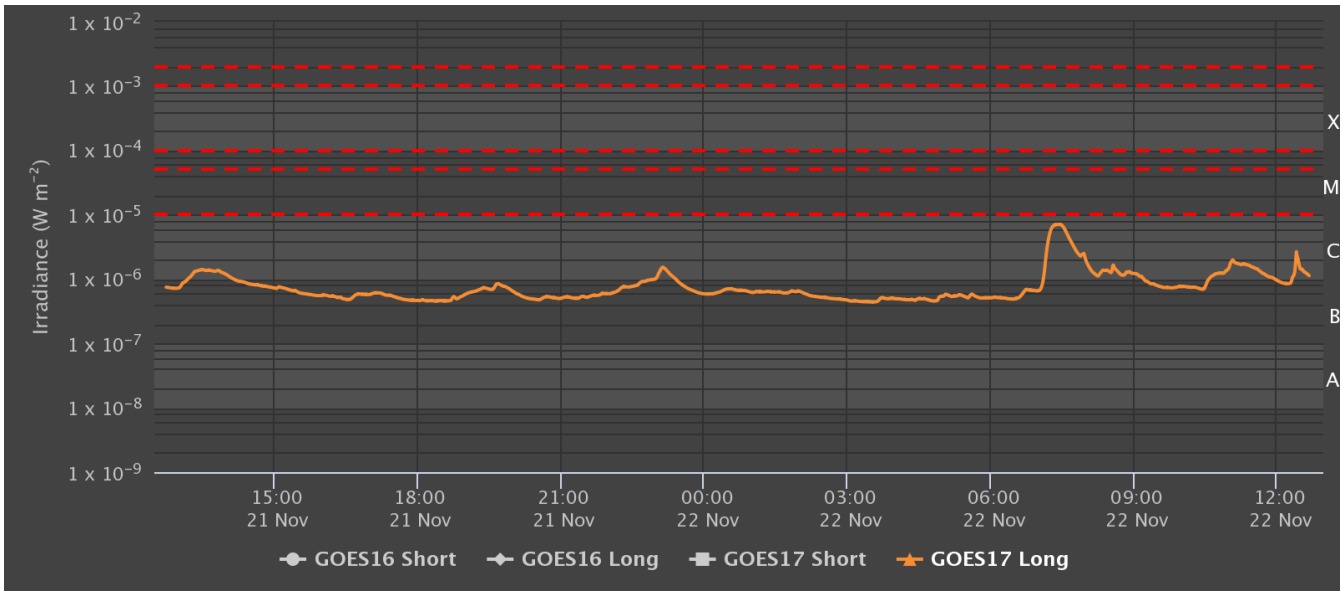
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Radio Blackouts - X-Ray Flares:
Solar activity has been Low over the past 24 hours, though the C7 flare at 22/0727 UTC from developing region AR3151 has resulted in the slight chance of an M flare increasing from 10% to 20%. AR3149 in the northeastern quadrant has also responsible for some C-class activity in the past 24 hours. This region appears to have stabilised recently.
There is one returning region potentially arriving (Ex-3135) on day 1 or 2. Current observations from STEREO EUVI 195 suggest that this is a relatively unremarkable region. The next arriving region of any size from NSO GONG far-side soundings is perhaps due over the UTC weekend.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: GOES17 X-Ray flares



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Met Office Space Weather Technical Forecast

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) at GEO, as observed by GOES16 is currently at background and expected to persist at this level.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES16 has been near Normal Background levels throughout the last 24 hours. This is now thought very likely to remain the case for much of the period, there are no further features of significant magnitude due in the forecast, CH47/+ included.

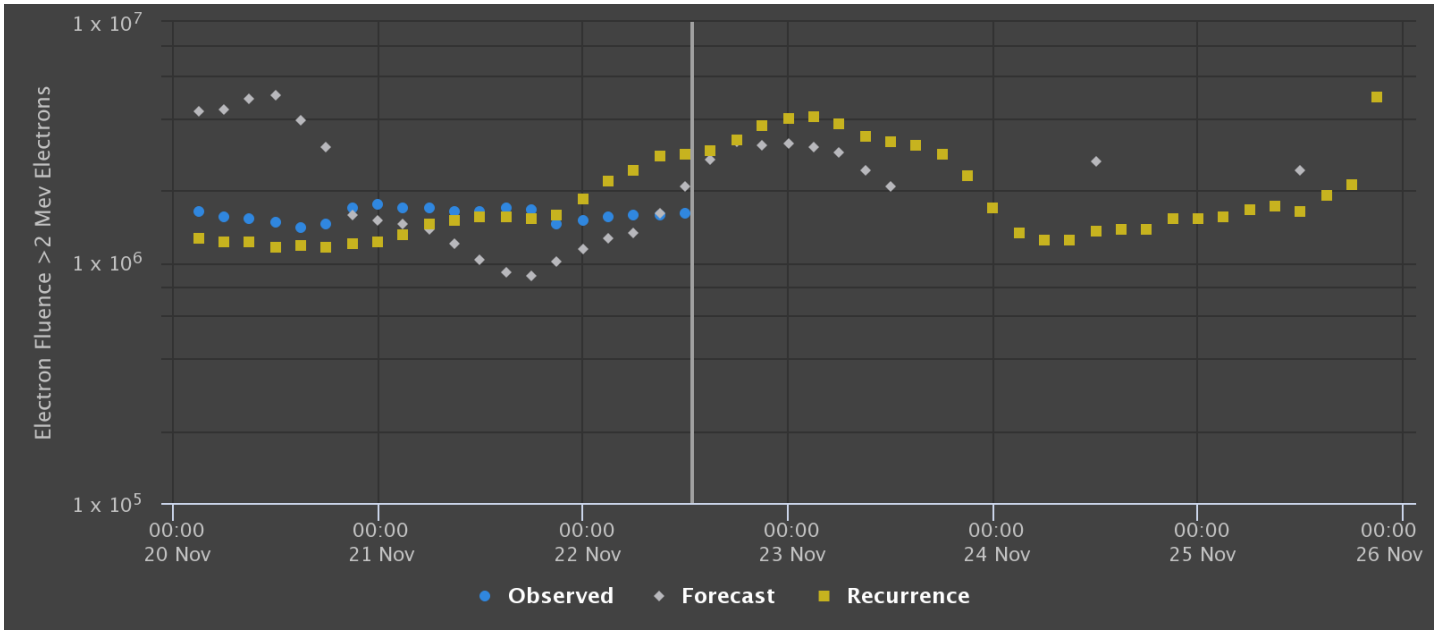
24-hour integrated electron fluence is expected to remain below the Active threshold throughout, as on last rotation, with CH48's predecessor the only upcoming feature that proved capable of raising counts, and this is forecast to be both lesser magnitude and later than on its previous pass, putting any significant electron fluence increase beyond the scope of the coming four days.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Figure 3: MOSWOC REF Model keeps fluence well below 1e8 Active level.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.